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EVALUATION OF CARDIAC RISK AND SUBJECT RESPONSE TO AMELIORATIVE--ETC(U)
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A follow-on survey was distributed to the student body and faculty three years following the initial cardiac risk assessment. Both program participants and non-participants were requested to complete and return the survey form. The survey evaluated the individual's perception of his current health, life-style changes which may alter cardiac risk, and factors influencing the individual's decision to reduce or ignore risk. The results of this survey are presented and their implications for military prospective medicine programs discussed.

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EVALUATION OF CARDIAC RISK AND SUBJECT RESPONSE TO AMELIORATIVE EFFORTS

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A group of mid-level military and civilian personnel attending a senior service school was provided the opportunity to participate in a cardiac risk evaluation program. Following the evaluation, each participant was provided an individual "Prescription for Health" suggesting methods for reducing factors with excessive risk through life-style alterations. The risk factors assessed included family cardiac history, obesity, smoking, pulmonary function, blood pressure, blood lipids, and physical fitness. The assessment was conducted in three stages: historical review of medical records and by questionnaire, blood chemistry and enzyme screen, physical examination and indirect determination of aerobic power. A follow-on survey was distributed to the student body and faculty three years following the initial cardiac risk assessment. Both program participants and non-participants were requested to complete and return the survey form. The survey evaluated the individual's perception of his current health, life-style changes which may alter cardiac risk, and factors influencing the individual's decision to reduce or ignore risk. The results of this survey are presented and their implications for military prospective medicine programs discussed.

The "20th Century Epidemic" describes coronary heart disease, the leading cause of death today in the western industrialized world.¹ The United States Air Force is not immune from the effects of this modern day epidemic as it represents one of the major causes of air crew medical disqualification.² It poses the threat of sudden physical incapacitation during flight operations; it strikes our most qualified and experienced senior personnel; and it draws heavily upon the fountain of fiscal resources.

Coronary heart disease is not easily classified according to the classical host-agent-environment relationship so well established for infectious disease. There are a number of probable causative and modifying factors, none of which may be absolutely necessary to the existence of the disease. It has been suggested that identifying these causative or risk factors in the individual offers greater motivation for him to reduce risk than simply providing broad, general health recommendations.³ To conduct such a prospective medical effort to significantly reduce this premature loss of experienced leadership will require support of the military services' senior staff. Such support may best be achieved through active participation in a prospective medicine designed cardiac risk reduction program.

CARDIAC RISK EVALUATION

A group of mid-level military and civilian personnel attending a senior service school, historically providing many of the nation's military leaders, was afforded the opportunity to participate in a cardiac risk evaluation. The program was conducted during the 1973-1974 academic year. Of the 190 eligible to participate in the risk assessment, 144 were students and 46 were staff or faculty. From this eligible population, 131 entered the program and 117 (90%) completed it (Table 1).

TABLE 1

CARDIAC RISK PARTICIPANTS

	Eligible	190
	Entering	131
	Completing	117 90%
Navy	31 (3 Marines)	
Army	29	
Civilian	29	
Air Force	28	

114 Male
3 Female

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The age distribution ranged from 39 to 69 years with a medium age of 43 (Table 2).

TABLE 2

AGE DISTRIBUTION OF PARTICIPANTS

30 - 34	3
35 - 39	35
40 - 44	53
45 - 49	19
50 - 54	4
> 54	3

The evaluation program was divided into a number of phases to facilitate management.

PHASE I. Introduction: The rationale for the program was explained to the class and staff at an elective assembly and their individual participation invited. Those desiring to participate were provided medical history questionnaires to complete and return.

PHASE II. Medical History: The medical records of military participants were obtained for review. For civilian participants, the cardiovascular history was obtained from the appropriate agency or from the individual's personal physician. The medical questionnaire and the medical records were reviewed principally for factors influencing cardiac risk:

Cardiovascular Disease	Current Medications
Smoking History	Physical Activity
Joint or Muscular Disorders	Body Weight History
Self Assessment of Job Related Emotional Stress	Family Medical History

A standard 12 lead EKG performed at rest in a fasting state was required of all participants within the preceding year. Any item of significance or questionable history was discussed individually prior to proceeding to the next phase.

PHASE III. Laboratory Evaluation: Arrangements were made for each participant to undergo a series of laboratory tests. These tests included: urinalysis, hematocrit, hemoglobin, white blood count, differential, and a blood chemical profile including triglyceride and cholesterol.

PHASE IV: Physical Assessment: Once the laboratory results were available and the medical history reviewed, each participant was scheduled for a physical assessment. They were instructed to wear exercise clothes and to eat nothing following a hearty breakfast. The assessment was performed in mid-afternoon in the following order:

1. Height and Weight
2. Three Site Skin Fold Measurement using Best Caliper
3. Vitalograph Pulmonary Function Screen
4. Casual Sitting Blood Pressure
5. Examination of Heart and Lungs
6. Final Interview to review the Personal History
7. Submaximal Exercise Test with EKG Monitoring

A Ramco Bicycle Ergometer provided the measured workload to achieve 80% of the maximal age dependent average heart rate. Based on the method of Astrand, the estimated maximal oxygen capacity was determined. A bi-polar 3-lead EKG was continually monitored. Rhythm strips and blood pressures were obtained each minute.

PHASE V: "Prescription for Health" : Once all the data were available, an individual risk analysis was prepared for each participant. A "Prescription for Health" was provided to the participant at the time his results were discussed, and individual recommendations were made regarding changes in life style to possibly result in risk reduction.

The following risk factors were assessed: family history, obesity, smoking, pulmonary function, blood pressure, blood lipids and physical fitness. Each risk factor had a numerical range increasing with the degree of risk (Tables 3, 4, 5, 6, 7, 8 and 9). Excellent physical condition has been suggested as a method of risk reduction. Those participants with excellent cardiovascular fitness were given a negative score of two points, thus reducing their over-all risk evaluation. All risk factors were correlated to obtain a single overall risk score. Results were as follows: 26 at low risk; 60 of average risk; 20 over-all longevity may be affected; 6 longevity is expected to be reduced; 5 premature deaths are anticipated unless there was a drastic alteration in life style.

TABLE 3

FAMILY HISTORY RISK FACTOR

	RF	%	#
a. No family history of cardiovascular disease	1	38	44
b. Coronary heart disease or stroke in parents or siblings >50 years old	2	56	55
c. Coronary heart disease or stroke in a single parent or sibling 40 to 50 years old	3	4	5
d. Coronary heart disease or stroke in more than 1 sibling or parent 40 to 50 years old	4	1	2
e. Coronary heart disease or stroke in any immediate family member < 40 years old	5	1	1

TABLE 4

OBESITY RISK FACTOR

	RF	%	#
a. Weight desirable or ideal for height	1	19	22
b. Weight does not exceed the desirable limits for height by more than 1.15	2	58	68
c. Relative weight is between 1.16 and 1.25	3	17	20
d. Relative weight is between 1.26 and 1.35	4	5	6
e. Relative weight is greater than 1.35 and the examinee is obviously obese	5	1	1

TABLE 5

SMOKING RISK FACTOR

	RF	%	#
a. Has never been a regular smoker	1	33	39
b. Been a regular smoker but has stopped, or smokes on irregular basis	2	44	52
c. Smoking 10 or less cigarettes or equivalent each day. Smoking a pipe regularly	3	6	7
d. Smoking between 10 to 20 cigarettes or equivalent each day. Smoking 2 or more cigars daily	4	3	4
e. Smoking over 20 cigarettes or equivalent each day	5	14	15

TABLE 6

PULMONARY FUNCTION RISK FACTOR

(Results are based on percentage of predicted normal)

	RF	%	#
a. Forced expiratory volume over 1 sec (FEV) 85% of vital capacity (VC) and a vital capacity equal to predicted	1	28	33
b. FEV, 75-84% of VC or VC between 90% and 99% of predicted	2	47	55
c. FEV, 65-75% of VC or VC between 80% and 89% of predicted	3	14	16
d. FEV, 60-64% of VC or VC between 70% and 79% of predicted	4	6	7
e. FEV 60% of VC or VC 70% of predicted	5	5	6

TABLE 7

BLOOD PRESSURE RISK FACTOR

(Diastolic will be measured at the point that the sound becomes muffled; for calculation of this risk factor age is not considered)

	RF	%	#
a. $\leq 135/85$	1	73	85
b. 136/86 to 150/90	2	18	21
c. 151/95 to 165/104	3	3	4
d. 166/105 to 175/112	4	3	4
e. $\geq 176/113$	5	3	4

TABLE 8

BLOOD LIPIDS RISK FACTORS

(Use the highest relative value to determine the risk factor)

	RF	%	#
Cholesterol less than 200 mg% and Serum Triglycerides less than 125 mg%	1	20	23
Cholesterol between 200-250 mg% or Serum Triglycerides between 125-250 mg%	2	45	53
Cholesterol between 251-300 mg% or Serum Triglycerides between 151-175 mg%	3	22	26
Cholesterol between 301-350 mg% or Serum Triglycerides between 176-200 mg%	4	5	6
Cholesterol over 350 mg% or Serum Triglycerides over 200 mg%	5	8	9

TABLE 9

AEROBIC POWER

Maximal oxygen uptake (ml/Kg/Min)

CONDITION	(AGE)	20-29	30-39	40-49	50-59	RF	%	#
Excellent		53+	49+	45+	43+	-2	7	8
Good		43-52	39-48	36-44	34-42	1	45	53
Average		34-42	31-38	27-35	25-33	2	39	46
Fair		25-33	23-30	20-26	18-24	3	5	6
Poor		< 25	< 25	< 20	< 18	4	2	2
Totally Unfit		Unable to measure due to exhaustion or onset of symptoms				5	2	2

THREE YEAR POST-EVALUATION SURVEY

Three years following the initial cardiac risk assessment a follow-on survey, consisting of a questionnaire, was distributed to the 1973-1974 student body and faculty. Both program participants and non-participants were requested to complete and return the survey form. The questionnaire assessed the individual's perception of his current health, life style changes which may alter cardiac risk, and factors influencing the individual's decision to reduce or ignore risk.

The survey was distributed to 140 former students and 19 staff or faculty totaling 159. Incorrect addresses resulted in 3 returns. Of the 156 successfully distributed questionnaires, responses were received from 137 individuals. This is a response rate of 88%. This phenomenal return might be explained by several factors: the discipline of the military profession, an interest in furthering the cardiac risk evaluation, and/or a desire to support the investigator. Responses were received from

123 students and 14 faculty or staff. The branch of service or Government agency was proportionally represented based on the 1973 distribution, although nine individuals had retired from Government service. The majority of the respondents considered themselves in excellent health - 106 (77%), 17 (13%) stated they were in good health and the remaining 14 (10%) reported their health as poor.

To the statement, "Since June 1974, I have become aware of having the following medical problems," these responses were received:

Alcohol Abuse - 2	Fatigue - 7
Arthritis - 3	Gout - 1
Blood Pressure Elevation - 12	Headaches (increased) - 9
Cardiac Problems - 9	Indigestion (increased) - 5
Diabetes - 1	Kidney Problems - 0
Depression - 2	Mental Anxiety - 3
Emphysema - 0	Obesity - 8
Emotional Problems - 4	Ulcer - 3

The respondent was requested to evaluate his current over all health status as compared with June 1974. The following summarizes the responses: improved - 21 (15%), the same - 99 (72%), and worse - 17 (13%). Specific questions addressed a number of life style factors from the stand point of changes since June 1974. The responses to these questions are summarized in Table 10.

TABLE 10
CHANGES IN LIFE STYLE

	Smoking	Aerobics	Weight	Lipid Intake	Tension
No Change	19	82	72	48	77
Decrease	14	36	28	89	35
Increase	7	19	37	0	25
Stopped Prior to 1974	97				

The survey was conducted among both participants and non-participants of the earlier risk program. Among the respondents - 111 (81%) had participated in the program. Many of the program participants were unable to accurately recall the risk score given them in early 1974. The risk score response follows: did not recall - 42 (38%), low risk - 39 (35%), average risk - 24 (22%), and high risk - 6 (5%). The survey requested the individual to consider a list of words in terms of positive, negative or no interest changes resulting from the cardiac risk evaluation program. Table 11 summarizes the positive responses on 121 questionnaires.

TABLE 11
EFFECT OF CARDIAC RISK EVALUATION PROGRAM ON HEALTH AWARENESS

Word or Phrase	Number of Positive Responses	Percent of Respondents (121 Questionnaires)
Alcohol	17	14
Animal Fat	41	34
Blood Pressure	28	23
Cardiac Risk	106	88
Cholesterol	83	69
Diet	74	61
Electrocardiogram	29	24
Emotional Tension	19	16
Emphysema	17	14
Exercise	58	48
Family Health	25	21
Health	47	39
Heart Attack	103	85
Overweight	97	80
Physical Examination	12	10
Physical Fitness	86	71
Polyunsaturates	71	59
Relaxation	29	24
Sex	33	27
Smoking	48	40
Triglycerides	39	32
Weight Control	72	60

Although a simplistic approach, increased awareness of these selected words and phrases is interpreted to parallel an increased awareness in related health factors. The responses exceeded the number of participants in the earlier study. This may imply that non-participants achieved a heightened health awareness from peer contact and conversations with enthusiastic participants. A decreased interest was reported for 11 items, the small number and scatter did not warrant further evaluation. The word "Sex" provoked an exuberant response from nine individuals. This is perhaps significant, for during the academic year of the Class of 74 there were anecdotal comments made by both husband and wife regarding the notable improvement in libido. This was generally related to improved physical fitness and may represent a very real benefit for middle aged males.

To judge the importance of the risk evaluation program as a source of health information the survey questionnaires requested the individual to prioritize 11 methods of health education. The three methods of health education consistently most important were the advice of physician, the physical examination and as expected the cardiac risk evaluation program. Another important source was the health experience of the family. The media: newspapers, magazines and television, generally received a low priority as a method of health education. Responses by 123 individuals again suggest the influence of the program on non-participants.

DISCUSSION

The purpose in conducting the survey three years following the initial evaluation program was to validate the risk evaluation score and to **assess effects on personal life style**. The program was greeted with enthusiasm and support from its inception and this continued to the end of the academic year. The support provided by the school was total; **and facilities immediately available encouraged participation in programmed physical activity**. In the three years since the programs inception similar risk evaluations have been available to the student body, though not as extensive. This year's class was joined by the students and faculty of a sister college sharing the same campus. A total of 447 from the two colleges participated in this accademic year's evaluation.

The total risk factor score given to each of the original participants implied prognostic value. From the information available, seven individuals including one death have experience a cardiac event, defined as a coronary occlusion or ischemic change evident on the electrocardiogram. Each of the seven had risk scores indicating a poor prognosis. A total of 31 were considered in this higher than normal risk group. Although there has been significant illness in the groups with less cardiac risk, there has been no reported coronary disease to date.

The questionnaire required no form of identification, thus permitting the respondent to be frank in his answer. However, over 90% of the forms were signed, thus greatly facilitating cross correlation with the previous evaluation. Correlation could not be demonstrated regarding the individual's current perception of his health status compared with illness reported or his previous risk score. Improved health was positively correlated with **increased physical activity** while a worsening of health paralleled increased weight, decreased physical activity and **resuming or increasing smoking**. The responses to changes in life style support a continuing effect of the evaluation program after three years. Approximately 70% of the participants were engaging in **vigorous aerobic physical activity** by June 1974. The response to the questionnaire indicates that over half have remained physically active. The most remarkable change for the respondents as a group has been the active effort to reduce the intake of animal fats. Analyses of the responses unfortunately failed to demonstrate a clear relationship of greater health motivated life style changes among participants. However, many of the recommendations provided the participants when he received his "prescription for health" were implemented prior to the end of the school year and continue to be followed. The questionnaire, unfortunately was not structured to permit evaluation of the degree of compliance with risk lowering recommendations, although over half of the respondents volunteered personal comments to that effect.

Reviewing the reported risk scores revealed approximately half of the participants were unable to accurately recall their scores. There was a degree of wishful optimism evident as 39 reported low risk scores, indicating an excellent prognosis, although in the original evaluation only 26 actually received such an excellent result. Of the six reporting a high risk score, five had experienced a cardiac event. This suggests below average results are best recalled following the predicted event. The educational process of the risk evaluation program was judged effective based on the **subjective increased awareness and interest of the participants to health related words**. Respondents demonstrated the natural tendency to show interest in these words related to personal experience when risk reduction efforts were being made. For example, those with elevated blood lipids indicated a positive response to cholesterol, animal fat, diet, polyunsaturates, and triglycerides. Conversely, those not making an effort to reduce a risk frequently were neutral in their response. An active smoker did not respond to smoking and emphysema nor would those with reported weight gain respond to weight control, overweight or diet. A vital element of the educational process for the cardiac risk evaluation program was the wives' lecture. General risk reduction recommendations were provided the wives, and they frequently became strong positive motivators for life style changes, producing possible prognostic improvements in their husbands. Although not included among the 11 sources of health education, several respondents added wives to the list.

A program similar to the Cardiac Risk Evaluation will motivate some to alter life style. However, such a voluntary effort may not reach the more recalcitrant. Not all students participated in the initial

evaluation and many of the non-participants self-selected themselves out knowing they possessed correctable high risk factors: i.e., overweight, smoking or a sedentary life style. Responses to the questionnaires indicate that less than half were continuing a risk lowering life style. Too frequently the pressure of the job, lack of facilities, a working lunch hour or no peer support have contributed to the demise of good intentions. To be effective in altering life style and thus reducing the impact of coronary disease among senior military personnel, a prospective medicine approach to ameliorate cardiac risk must be institutionalized. A three year follow-up of an individualized program dependent on self-motivation for risk reduction has demonstrated only marginal success in participant commitment to health centered life-style modifications.

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